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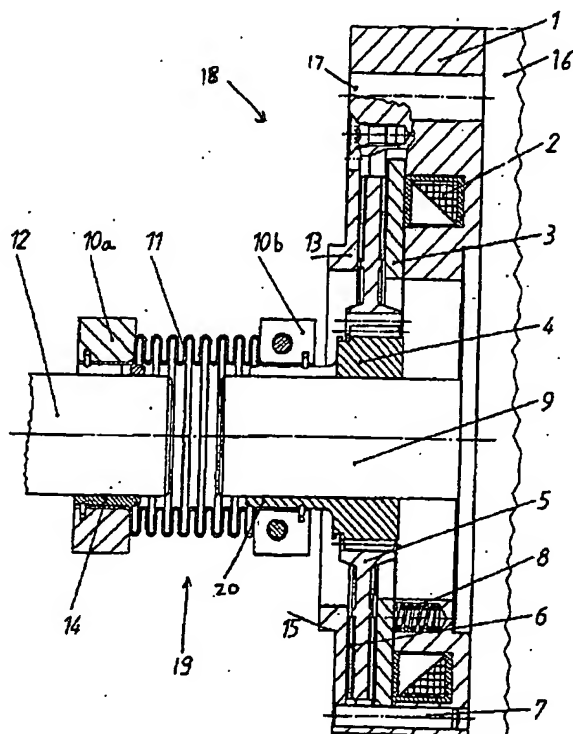
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(54) Title: **COUPLING AND BRAKE COMBINATION**



(57) Abstract: A brake coupling combination for a motor, preferably an electric motor, consisting of a brake which can be attached to the motor, the brake having a flange (1) with which it is directly connected to a correspondingly shaped part of the motor, characterized in that the brake is mounted on the end of the shaft (9) of the motor by means of a hub (4) and that a flexible coupling (K) connects directly to the brake for connection to a second shaft.

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Coupling and Brake Combination

Safety brakes which release upon the application of an electric current and which operate by means of spring pressure when the current is removed, are in general known. They are usually mounted on the rear side of the motor, generally an electric motor, on the so-called B-bearing side.

In countless technical installations for example lifts, it is required by the regulations to include a safety brake which in the event of a fault for example, a power cut, immediately brings the system to a standstill, and holds it in this condition until the fault has been repaired. The inclusion of such brakes means additional installation work, and requires more space.

Flexible bellow couplings that are stiff in the rotational direction, are known for connecting two shafts. They are mainly installed between an electric motor and a drive coupling, working machine, spindle or the like.

The object of the present innovation is to unite a coupling and a brake into a unit, a so-called brake coupling combination in such a way that this unit can be mounted in a simple manner on the drive side of an electric motor (A-bearing side). The aim is in particular, to reduce the work and space requirement. Additionally, costs need to be saved, reliability increased, ease of servicing

improved. Preferably the arrangement should be able to compensate for a high degree of misalignment between drive and driven shafts.

This task is solved by the fact that the hub of the brake, which transmits the angular momentum of the shaft to the brake, is constructed so that it forms at the same time the drive side of the output coupling, which preferably is a flexible bellows coupling. The second side of the coupling transfers the angular momentum to the second shaft. With this arrangement space is saved in the axial direction. The stiffness to rotation of a bellows coupling can absorb at the same time axial, radial and angular misalignment. Further, the housing of the safety brake may be constructed in a generally rectangular shape, so that the usual shape of electric servomotors is preserved. By mounting the brake on the drive motor shaft rather than on the rear end of the motor an improvement in safety is achieved. For example if the brake hub becomes disconnected from the motor shaft due to a mechanical failure, in the arrangement of the invention, the drive becomes disconnected too. This is a "fail-safe" situation, and is due to the fact that the drive passes from the motor shaft to the drive external equipment via the brake hub.

An exemplary embodiment of a brake coupling combination, in accordance with the invention will now be described with reference to the drawings in which:

Figure 1 shows a simplified elevation of the coupling-brake combination;
Figure 2 shows a cross-section on the line A-A in Figure 1 and shows more detail;
Figure 3 shows an exploded partly cross sectional view showing coupling of the coupling brake combination to the motor shaft; and
Figure 4 shows a spring clip for use in the arrangement of Figures 1-3.

Referring to Figure 2, a brake-coupling combination is intended to be flanged or screwed on to an electric motor 16 at the A bearing side i.e. the end from which the drive shaft emerges. In Figure 2 the motor shaft is shown, with the reference

numeral 9. The brake coupling combination essentially consists of a brake assembly 18 and a coupling assembly 19. The brake possesses a square flange 1, with which it is screwed to a correspondingly shaped part, for example to the A-bearing case of a servomotor, or the motor housing. The flange 1 serves at the same time as a housing for the brake, and accommodates the many individual parts thereof. Typically the brake coupling assembly is bolted onto the motor 16 by four bolts, one of which passes through bore 17. The bolts are not shown in Figure 2.

The brake assembly 18 itself consists of an electromagnet coil 2; an armature plate 3; a hub 4 with a partially axially slit tube-like extension 20, the hub 4 is connected to the motor shaft 9 such that relative rotation is not possible. This may be achieved for example by use of a key in a keyway, or other conventional means such as a taper or cross pin.

The brake also includes at least one brake disk 5 which is longitudinally displaceable with respect to the hub 4 but which is connected to it such as to turn with it. The brake disk 5 is sandwiched between the armature plate 3 and a flange plate 13 which is longitudinally fixed with respect to the housing of the brake. Brake pads 6 are mounted on either the brake disk itself or on the surfaces of the armature and flange plate facing it to increase friction between these components. Typically the hub 4 carries on its outer circumference, splines which engage inwardly facing teeth on a boss in the centre of the brake disk 5. The brake assembly 18 also has at least two brake pads 6, disposed on the two sides of the brake disk 5. The brake also includes a plurality of guide pins 7 disposed and equally distributed around the circumference to ensure good alignment of the moving parts in operation. Springs 8 also disposed and equally distributed around the circumference urge the armature plate towards the flange plate, and hence into the braking condition. The brake pads 6 may be fixed to the brake disk, so as to engage the inwardly facing surfaces of the armature plate 3, and a flange plate 13 on the other side of the brake disk 5. Alternatively the brake pads

can be on the mutually facing surfaces of the armature plate 3 and the flange plate 13.

The shaft 9 of the motor 16 passes through the hub 4 including the partially axially slit tube-like extension 20 and into the coupling unit 19 of the coupling brake combination.

The coupling unit 19 couples the motor drive shaft 9 with a driven shaft 12 connecting to other machines and consists of flexible bellows 11 (preferably made of metal), by a locking ring 10b locked onto the motor shaft 9 via the tube-shaped axially slit extension 20 of the hub 4 at one end and on a correspondingly adapted coupling hub 14 that is in turn locked onto a driven shaft 12, at the other end.

The flange plate 13 as well as holding the brake together, and providing the reaction force, also offers the possible connection of drive transmission by means of a centering adjustment 15.

In operation, when the electromagnet coil 2 is excited it attracts the armature plate 3 thereby pulling the armature plate 3 away from the brake disk. Once there is no longer any frictional contact between the armature plate 3, the brake disk 5, the brake pads 6 and the flange plate 13 there is no braking effect. If the electricity supply to the electromagnet coil 2 is interrupted, the armature plate 3 is released, and is immediately moved in the direction of the brake disk 5 and flange plate 13, by the springs 8. As the brake disk 5 is free to move longitudinally on the splines on the hub 4, it moves in the direction of the flange plate 13, balancing the braking effect on the two sides of the brake disk.

The flexible bellows 11 are movable in all directions and can compensate for any kind of misalignment of the shafts, axial, radial and angular. By the attachment by the locking rings 10 or 10' (radially slit and clamped by a screw not shown in more detail), the flexible bellows 11 can be secured on the short end of the shaft

so that space can be saved. The locking rings 10, 10' in addition, achieve a locking of the bellows and the locking between the hub 4 and the drive shaft 9 on the one hand, and the coupling hub 14 and the drive shaft 12 on the other hand

Referring to figure 3, there is shown an exploded view of a portion of the coupling and brake combination. The same or corresponding parts have been given the same reference numerals as in Figures 1 and 2. Figure 3 shows a motor shaft 9, and a hub 4 which supports a brake disk (not shown). The hub 4 is sized to fit on the motor shaft 9 and has key-ways (not shown) to prevent mutual rotation between the shaft 9 and the hub 4. The hub 4 has a longitudinally extending cylindrical sleeve portion 20 which has one or more longitudinal slits 23. It also has an outwardly facing annular groove 21 in its outer cylindrical surface. A metal bellows assembly 11 has a generally cylindrical right hand-end 26 sized to fit over the left-hand end of the cylindrical sleeve forming the extension 20 of the hub 4. The metal bellows assembly 11 is held in place on the extension 20 of the hub 4 by means of a locking ring 10b sized to fit around the cylindrical end 26 of the metal bellows 11. The locking ring 10b has an inwardly facing annular groove 22 in its inner surface, to receive a spring clip 25. The spring clip 25 is shown in Figure 4. As it is located in the annular groove 22, as the locking ring 10b is passed over the sleeve 20, but before it is tightened down, the spring clip 25 comes to rest in the outwardly facing annular groove 21. This serves to locate the locking ring 10b on the sleeve 20.

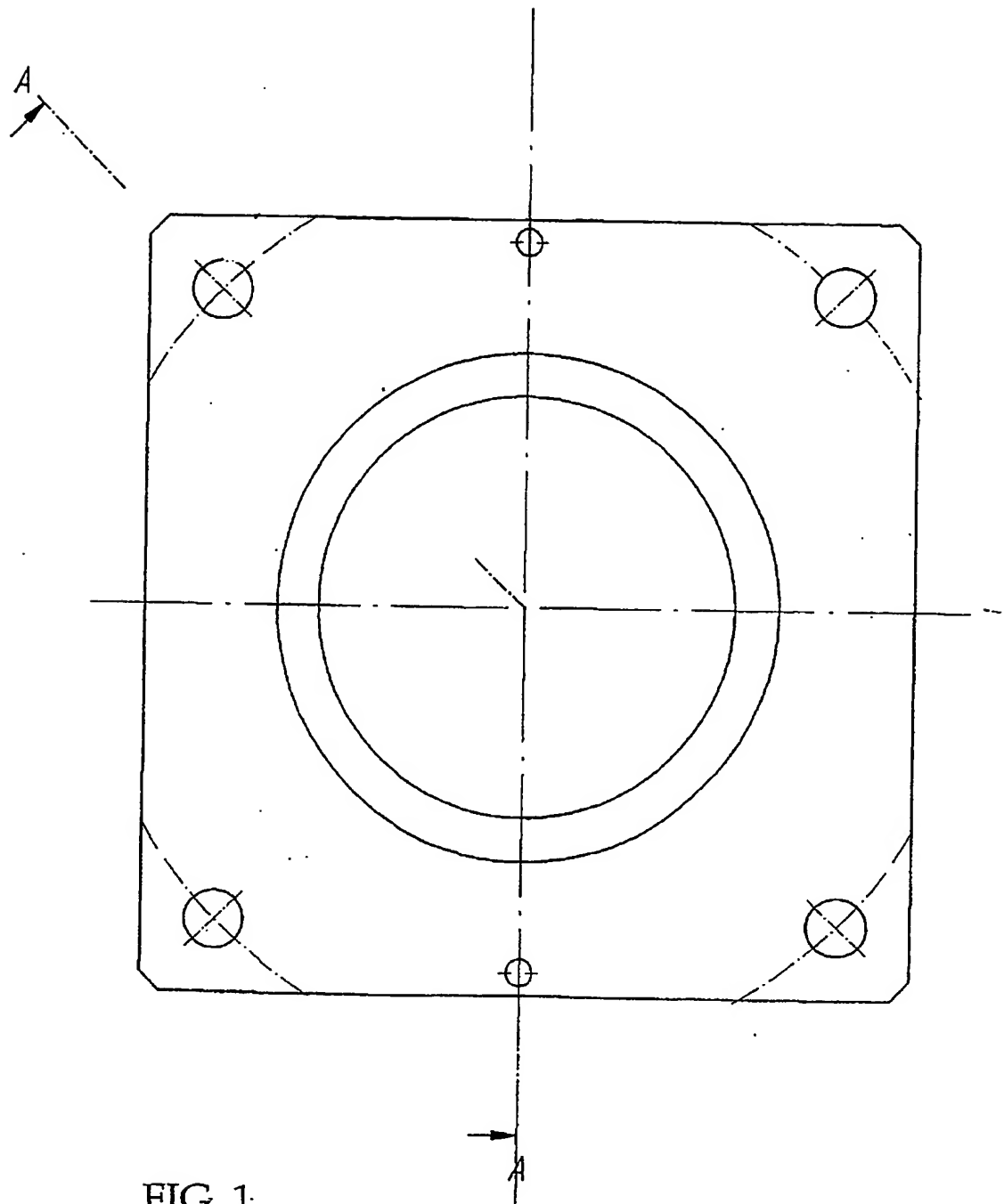
The locking ring 10b has a radial split or slot with a tangential bolt 24 passing across it. When the locking ring 10b is assembled and in place around the cylindrical end 26 to the metal bellows assembly 11, which in turn is in place on the cylindrical extension 20 of the hub 4, the bolt 24 can be tightened. This urges the radial slot in the locking ring 10b closed, which causes the ring to grip the cylindrical extension 26 of the metal bellows 11 against the outer surface of the extension 20 of the hub 4. The tightening also tends to urge the slot 23 in the cylindrical sleeve 20 of the hub 4 in a closing direction, thereby causing the hub 4

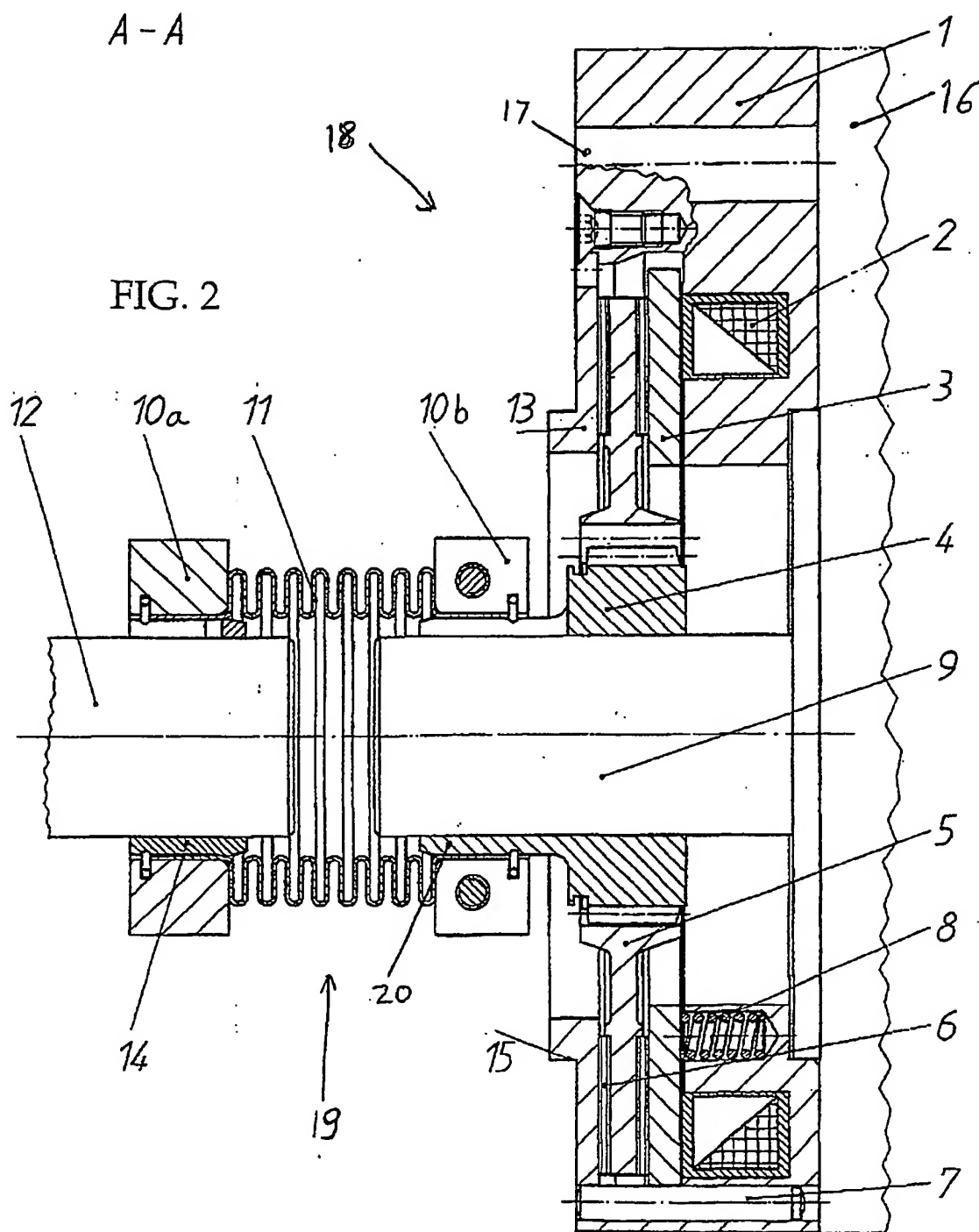
to grip tightly against the motor shaft 9. Accordingly, the locking ring 10b serves a dual function of holding the metal bellows 11 to the brake hub 4 and also holding the brake hub 4 to the motor shaft 9. This is particularly advantageous because it dispenses with the need to provide a separate fixing means to prevent longitudinal movement of the brake hub 4 with respect to the motor shaft 9. The result is that the flexible coupling can be mounted closer to the motor. This is particularly advantageous in situations where there is a limited amount of available motor shaft, or a limited amount of space for the entire assembly. Such situations are common when a brake is being retrofitted to an existing installation. The coupling and brake combination in accordance with the present invention therefor saves a considerable amount of space and allows braking assemblies to be retrofitted to motors in spaces which were previously considered too small.

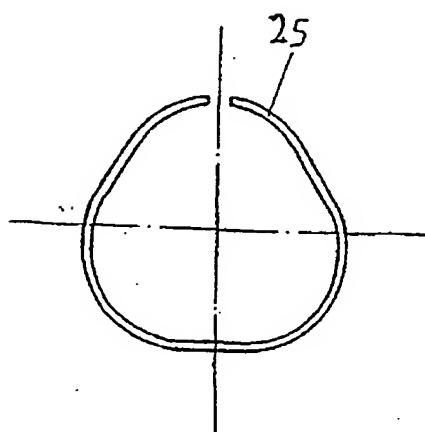
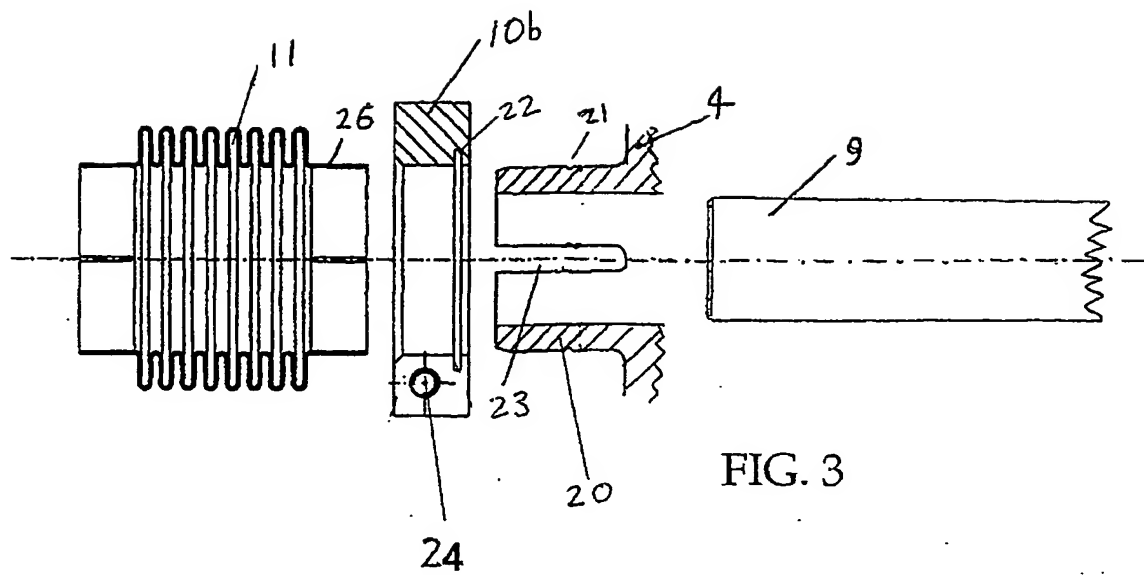
Claims

1. A coupling and brake combination for a motor, preferably an electric motor, the brake having a flange (1) for directly connecting the combination to the correspondingly shaped part of the motor housing, characterized in that the brake is attached by means of a hub (4) on the motor shaft (9) of the motor, and that the hub (4) connects directly to a coupling (11) for transmission of motor rotation to a second shaft.
2. A combination according to claim 1 characterized in that the coupling (11) is a metal bellows coupling.
3. A combination according to claim 2 characterized in that the metal bellows coupling is non-rotatably connected to the end of the shaft (9) by means of a locking ring (10b).
4. A combination according to claim 3 characterized in that the locking ring (10b) simultaneously clamps the flexible metal bellows (11) and the hub (4) to the motor shaft (9).
5. A combination according to any of claim 2, 3 and 4 characterized in that the end of the flexible metal bellows (11) remote from the motor shaft (9) is clamped to a second shaft (12) by being sandwiched between a split sleeve mounted on the shaft and a split locking ring (10a) clamping down on the outer circumference of the end of the said remote end of the bellows.
6. A combination in accordance with any preceding claim characterized in that the flange (1) comprises a housing accommodating the various components of the brake.

7. A combination in accordance with any preceding claim characterized in that the brake consists of an electromagnet coil (2), an armature plate (3), the hub (4), at least one brake disk (5), at least two brake pads (6) and at least one spring (8) that presses the armature plate (3) in the braking direction.
8. A combination in accordance with any preceding claims characterized in that the flange (1) is rectangular preferably square.
9. A combination according to any preceding claim characterized in that the hub (4) of the brake is directly mounted on the motor shaft (9) and is provided with an outwardly axially projecting tube-like slotted projection (20) also mounted directly on the motor shaft (9), wherein the flexible coupling (11) has a cylindrical gripping end which is mounted over the axially projecting tube-like slotted projection (20), a locking ring (10b) being provided to hold the cylindrical gripping end of the flexible coupling to the projection (20) and simultaneously hold the projection (20) to the motor shaft, (9).
10. A method of retrofitting an electric motor by installing a brake and coupling combination in accordance with any preceding claim to the A bearing side of the motor.







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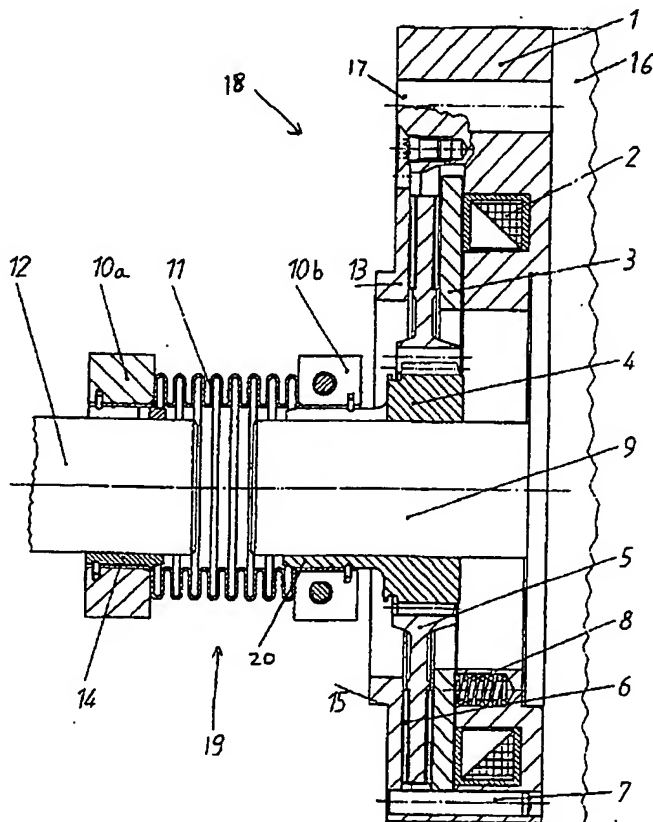
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B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

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Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 786 852 A (SIEMENS AG) 30 July 1997 (1997-07-30)	1,6-8,10
Y	column 3, line 10 - line 15; figure 2	2-5
X	US 3 338 349 A (KLINKENBERG HUBERT E ET AL) 29 August 1967 (1967-08-29)	1,6-8,10
Y	figures 1,3	2-5
Y	WO 99 47827 A (MAYR CHRISTIAN GMBH & CO KG ;EBERLE JOHANN (DE); VOGL NORBERT (DE)) 23 September 1999 (1999-09-23) the whole document	2-5
P,A	DE 199 54 590 A (LINDE AG) 17 May 2001 (2001-05-17) figure 2	1

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Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 0786852	A	30-07-1997	DE 59702363 D1 EP 0786852 A1	26-10-2000 30-07-1997
US 3338349	A	29-08-1967	NONE	
WO 9947827	A	23-09-1999	DE 19812223 A1 WO 9947827 A1 EP 1064468 A1 JP 2002506957 T US 6413164 B1	23-09-1999 23-09-1999 03-01-2001 05-03-2002 02-07-2002
DE 19954590	A	17-05-2001	DE 19954590 A1 FR 2801144 A1	17-05-2001 18-05-2001